**Original Manuscript ID:** Access-2022-25705

**Original Article Title: “**CNN Sensor Analytics with Hybrid-Float6 Quantization on Low-Power Embedded FPGAs.”

**To:** IEEE Access Editor

**Re:** Response to reviewers

Dear Editor,

Thank you for allowing a resubmission of our manuscript, with an opportunity to address the reviewers’ comments.

We are uploading (a) our point-by-point response to the comments (below) (response to reviewers), (b) an updated manuscript with yellow highlighting indicating changes (*Supplementary Material for Review*), and (c) a clean updated manuscript without highlights (*Main Manuscript).*

Best regards,

Yarib Nevarez et al.

**Reviewer#1, Concern # 1:** Line numbers are missing from pages 11, 12, and 15.

**Author response:** Sorry for this problem. But as far as I noticed this problem should have been generated in the PDF version by the submission tool.

**Author action: -**



**Reviewer#1, Concern # 2:** Page 6: column 2, Figure 5: You show the output as 32-bit floats. However, Figures 6 and 7 show 64-bit outputs. Is this a typo in Figure 5?

**Author response:** Thank you for your comment and sorry for the confusion caused by our description. The hardware dot-product produces a 32-bit float, which is the normalized value of the internal accumulator. This accumulator is a register of 64-bit fixed-point with 23-bit fraction. This is stated in Section IV.-B-2 and in Figure 7.

**Author action:** We updated the manuscript by clarifying this point in Section IV.B-2.



**Reviewer#1, Concern # 3:** Page 11, column 1, Figure 12: The CNN regression model proposed has very few layers. It would be interesting to see your proposal implemented in a more SOTA CNN, such as Yolo V7.

**Author response:** We completely agree. Since, SOTA CNN, such as Yolo V7 are out of the scope of low-power sensor analytics, this is would be part of a future work.

**Author action:** We updated the manuscript by adding this point in Section V.D-4.



**Reviewer#1, Concern # 4:** Page 11, column 1, around line 50: 10 epochs and such small sample sizes, while possibly stretching your proposed model, are insignificant to a more SOTA model.

**Author response:** Yes, exactly. It is insignificant compared to SOTA models since they are designed for computer vision applications, which require higher capacity of feature extraction.

**Author action: -**



**Reviewer#1, Concern # 5:** Page 11, column 2, around line 55: "imput". Spell and grammar check the document.

**Author response:** Thank you very much.

**Author action:** We updated the manuscript by correcting the misspelling.



**Reviewer#1, Concern # 6:** Page 11, column 2, around line 45: How long did Hybrid Log 6-bit QAT take?

**Author response:** The QAT time is 185 minutes. This is stated at the end of Section V. B-4.

**Author action: -**



**Reviewer#1, Concern # 7:** Page 13, column 2, Figure 15: For ease of reading, please label your axes.

**Author response:** Yes.

**Author action:** We updated the manuscript by adding the axes.



**Reviewer#1, Concern # 8:** Page 15, column 1, Figure 17: The figure appears to have an Error distribution and two versions of the Loss Distance Histogram. Is this intentional?

**Author response:** Thank you for the observation. In fact, all are 2D error distributions.

**Author action:** We updated the manuscript by removing the small labels from Figure 18 (of the updated version), since the graphs are stated as 2D error distributions in the figure description. As mentioned in the manuscript, the three rows in the figure correspond to three different models. For more clarifications, we also highlighted that in the figure.

We also corrected Figure 15 (of the updated version) by changing the labels from “error distribution “ to “2D error distribution” on the corresponding places.



**Reviewer#2, Concern # 1:** The flowchart of the software that was downloaded on the Cortex-A9 processing system (PS).

**Author response:** Thank you for your comment. We completely agree.

**Author action:** We updated the manuscript by adding the software flowchart in Section IV.D.



**Reviewer#2, Concern # 2:** There are some sentences that needed to be reviewed again.

**Author response:** Thank you very much for your detailed review.

**Author action:** We updated the manuscript by addressing all the points.

**Reviewer#2, Concern # 3:** Page 6, line 57 of-chip –> off-chip

**Author response:** Thank you for your comment.

**Author action:** We revised the manuscript by correcting the misspelling.

**Reviewer#2, Concern # 4:** Page 8, line 44, you need to mention the unit of the grid dimension (10x10)!

**Author response:** The 10x10 grid are divisions on the metal plate area (90 cm x 86.6 cm).

**Author action:** We updated the manuscript by clarifying the grid division on the metal plate area.

**Reviewer#2, Concern # 5:** Page 10, col 2 , last paragraph “imput” change to (input)

**Author response:** Thank you for your comment.

**Author action:** We revised the manuscript by correcting the misspelling.

